Attachment 2

...defines the specifications and requirements for BTeV Superconducting Corrector Magnets.

I Cryogenic Operating Conditions.

The BTeV C0 IR corrector magnets will operate in **4.5K liquid helium at a pressure of 2.2bar**.

II Maximum Operating Current.

The BTeV C0 IR corrector magnets must reach the required operating strengths with currents **less than 100A,** the power supply limit.

III Quench Performance

The BTeV C0 IR corrector magnets must reach the required maximum strengths without quenching during normal operation, independent of the fields due to excitation of the other correctors in the same assembly.

IV Number of Corrector Magnet Assemblies Required.

X1 Spools
- V/H Dipole (±45° coil scheme), Sextupole, Strong Quadrupole
- 4 installed spools, 1 spare spool, 1 spare corrector assembly
- Total: 6 X1 corrector magnet assemblies

X2 Spools
- V Dipole, H Dipole
- 4 installed spools, 1 spare spool, 1 spare corrector assembly
- Total: 6 X2 corrector magnet assemblies

X3 Spools
- V Dipole, H Dipole, Skew Quadrupole
- 2 installed spools, 1 spare spool, 1 spare corrector assembly
- Total: 4 corrector assemblies

Total: 16 corrector magnet assemblies

V Corrector Magnet Assembly Dimensional Limits

C0 IR Corrector Magnet Requirements Dimensional Constraints			
Spool	**Maximum Overall Length♦ (mm)**	**Minimum ID♦ (mm)**	**Maximum OD♦ (mm)**
X1	**1200**	**70**	**250**
X2	**550**	**70**	**250**
X3	**800**	**70**	**250**

T. Page would like to change maximum OD to 160-180mm and standardize for all correctors to permit identical support systems

VI Corrector Magnet Field Strength Requirements:

C0 IR Corrector Magnet Requirements Strengths at Maximum Field *Note: Maximum Current ≤100A (power supply limit)*						
Spool	**Maximum Overall Length (mm)**	**VD T. m**	**HD T. m**	**SQ T.m/m**	**Sx T.m/m^2**	**Q* T.m/m**
X1V	**1200**	**0.48**			**450**	**25**
X1H	**1200**		**0.48**		**450**	**25**
X2	**550**	**0.48**	**0.48**			
X2	**550**	**0.48**	**0.48**			
X3	**800**	**0.48**	**0.48**	**7.5**		
X3	**800**	**0.48**	**0.48**	**7.5**		
X2	**550**	**0.48**	**0.48**			
X2	**550**	**0.48**	**0.48**			
X1V	**1200**	**0.48**			**450**	**25**
X1H	**1200**		**0.48**		**450**	**25**

♦ The limits define a 'slot length' in the spool: the maximum extent the complete magnet assembly - coils, iron, end pieces, support structure, etc. - is allotted

VII Corrector Magnet Field Non-Uniformity Limits

Limits Updated by J. Johnstone

C0 IR Corrector Magnet Requirements Field Quality – Limits on Harmonics					
	X1, X2 Dipoles 0.48 T. m	**X1 Sextupole 450 T.m/m^2**	**X1 Strong Quad 25 T.m/m**	**X3 Dipoles 0.48 T. m**	**X3 Skew Quad 7.5 T.m/m**
	[|bn|, |an|] **max** (units)	[|bn|, |an|] **max** (units)	[|bn|, |an|] **max** (units)	[|bn|, |an|] **max** (units)	[|bn|, |an|] **max** (units)
b_0		**75**	**35**		**35**
a_0	**50**	**75**	**35**	**25**	**35**
b_1	**50**	**75**		**25**	**75**
a_1	**75**	**75**	**75**	**40**	
b_2	**75**		**75**	**40**	**75**
$a_{n>1}$	**75**	**75**	**75**	**75**	**75**
$b_{n>2}$	**75**	**75**	**75**	**75**	**75**

These are maximum acceptable values. The corrector design should accommodate all manufacturing tolerances so that no measured harmonic coefficient exceeds its limit. The reference radius for harmonic calculations is 25.4mm.

VIII Corrector Magnet Current Ramp Rate Requirements

[TBD - first pass estimates from J. Johnstone]

Horizontal and vertical dipoles:	**12 A/sec**
Skew quadrupole	**9 A/sec**
Sextupole	**7 A/sec**
Strong quadrupole (Q*)	**6 A/sec**

Note: scaled from existing corrector ramps, with estimates of new corrector transfer function, and some additional margin.

IX Corrector Magnet Alignment

Nested correctors which are wound together present an interesting situation – they are not independently adjustable

Approach:

- **Define "primary" corrector in each package**
  - **X1 – "Q*" strong quadrupole corrector**
  - **X2 – HD/VD 45° scheme ?**
  - **X3 – HD/VD 45° scheme ?**
- **Set alignment lug w/respect to primary corrector**
- **Measure offsets of other correctors w/respect to primary**

IX.2 Field Angles

[TBD- the following is a first pass guess]

'Primary': ±1 mrad (alignment monument on flange)

Relative – other corrector w/res to primary: ±2 mrad

(fabrication tolerance on coil to coil alignment)

(Note: field angle is an average over the coil; is a twist tolerance also needed??)

IX.3 Field Centers

[TBD- the following is a first pass guess]

'Primary' - ±.005in?? need more information on materials & fabrication tolerances ?

Relative – (see previous comment)